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Energy Notes

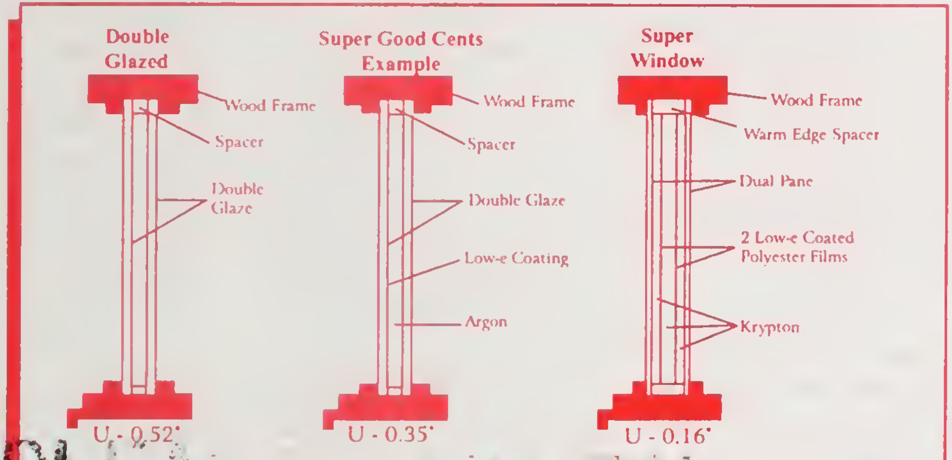
Windows And *Super Good Cents*

Ten years ago double pane windows were standard, and so was condensation in cold weather. Today, heat-reflecting coatings and gas fills keep both occupants and window surfaces warmer, avoiding condensation in all but the very coldest weather. Technology improvements have almost doubled the energy performance of windows in the last ten years. This edition of Energy Notes will discuss what makes a window efficient, and how to choose the right windows for Super Good Cents houses.

Houses need windows to let in light, fresh air, and solar heat, but windows are net losers of heat when the sun isn't shining. Days are shorter during the heating season, so the amount of sunshine available for solar heating decreases just when it is most needed. The task is to choose windows that will allow solar heat gain when it is needed and available, but minimize heat loss when the sun is not shining.

Figure 1 shows three examples of windows. The first is what went into most homes built before the mid 1980s. The second is the standard for Super Good Cents homes today, and the third falls into t[illegible] dows."

Figure 1. Window Comparison



*U-values taken from the 1994 Super Good Cents window default tables.

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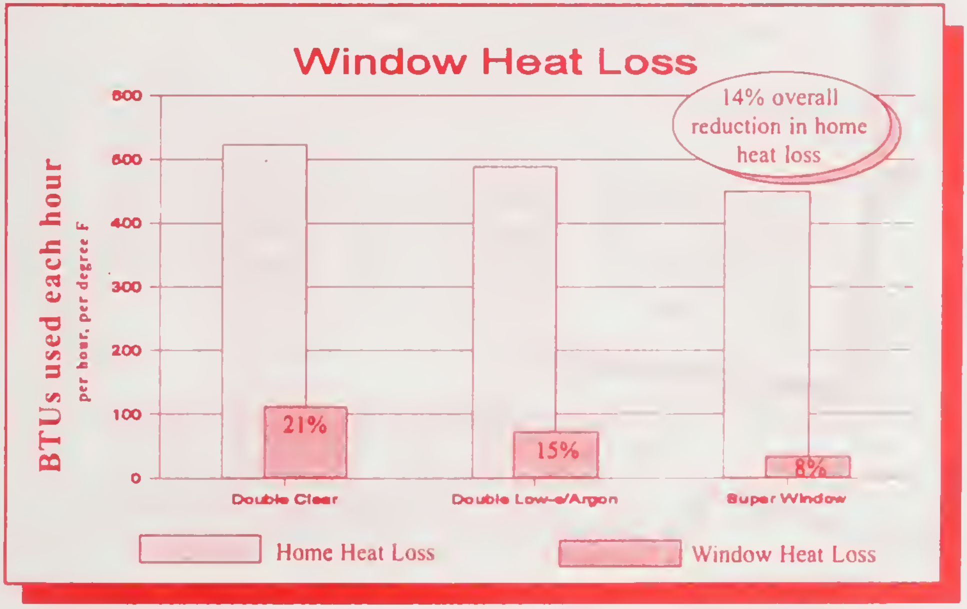
Figure 2 illustrates how changing windows affects the home's heat loss. The average 1,800 square foot Montana house has about 216 square feet of windows, equaling about 12 percent of the floor area. Those windows commonly account for more than 20 percent of the home's total heat loss. Selecting more energy efficient windows can cut that heat loss significantly and ultra high efficiency windows can be as effective as the walls at stopping heat loss.

Figure 2. How Different Windows Stack Up



The Super Good Cents Program

Super Good Cents is an efficiency program sponsored by electric utilities that shows people how to build energy-saving features into their new homes. These houses cost less to heat, and are quiet and comfortable. Participating utilities offer the program as part of a strategy to continue meeting the electricity needs of their customers without building costly new power plants.

The Super Good Cents representative at the utility serving each home site will help prospective builders include energy-saving features into nearly any set of house plans so the finished home qualifies for the program. Energy features include insulation, windows and doors, air sealing, and ventilation.

Builders need to know two things when shopping for Super Good Cents windows. First, the windows must have a U-value rating of 0.35 or less. Second, the rating must come from the National Fenestration Rating Council (NFRC).

What Makes Up a 0.35 Window?

In a nutshell, most Super Good Cents-approved windows will be double glazed with a low-e coating, wood or vinyl framed, and have at least a half inch air space filled with an inert gas. (Gas fills are explained in the "Component" section.) Windows with these features don't automatically qualify for Super Good Cents, they must be rated. There also are windows that achieve the 0.35 with different combinations of components, so ask your window supplier for the product's NFRC rating. Most Montana window businesses carry several lines that will meet SGC requirements.

Do All Windows Have to be Labeled?

Super Good Cents requires NFRC labels for windows and patio doors, both sliding and swinging, but skylights and doors with glass are not required to have the NFRC label.

Windows for Super Good Cents

For a house to qualify for Super Good Cents incentives the windows must meet the following criteria:

- "A" U-Value 0.35 or lower
- NFRC Label

See your local Super Good Cents utility representative for details.

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NFRC Rates Windows

The National Fenestration Rating Council (NFRC) developed a nation-wide window rating system that makes it easier for consumers to compare window products. In the past there were no guidelines that the entire industry followed for window testing. This lead to inconsistencies in test results.

Since windows are made up of components that transfer heat at different rates, it is inaccurate to use the insulating properties of only one part, such as the glass or frame, to represent thermal performance. NFRC ratings are based on how the entire window unit transfers heat.

Windows are categorized by their sash type, (casement, awning, patio door...) and NFRC specifies two different sizes manufacturers must test for each product line. Uniform testing procedures mean the consumer can compare apples to apples, instead of apples to bananas or kiwi fruit.

About the NFRC Labels

The ratings are displayed on a label, similar to the Energy Guides on appliances. Most of the windows available in Montana already have NFRC ratings. A few are in the rating process and should have labels soon.

Some manufacturers have their products rated, but only put labels on the windows if they know the customer needs proof.

There are two ways to identify NFRC certified windows. The figure below shows the temporary label, which gives the window's performance rating. A permanent label or marking is also attached to the frame, usually where it won't be seen when the window is closed. The permanent label does not carry the performance rating, but shows that the window has been rated.

The Super Good Cents representative checks the sticker before they certify the house. *They look at the "A " rating.* Window purchasers should inform suppliers that an NFRC sticker is needed.

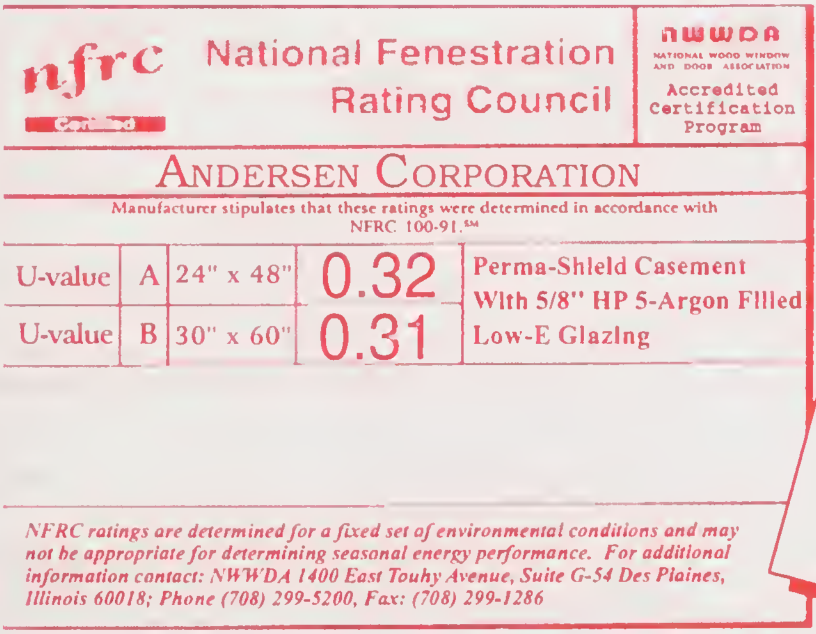
The NFRC Directory

The NFRC Certified Products Directory lists all windows that carry current ratings. Each window manufacturer submits all of its product lines, so under one company there may be ten casement windows listed with different combinations of low-e, gas or air fill, spacers and frames.

The directory is updated frequently as more products are tested. It contains an explanation of NFRC's testing procedures and performance standards. Utilities should have the most current directory available for those interested in more information.

On the Horizon

NFRC began rating entry doors in 1994. Although individual door manufacturers don't plan to advertise NFRC ratings until the entire industry switches over, those rated will be listed in the NFRC directory. Air leakage and solar heat gain information for windows will be included in future directories.


nfrc
Certified
NWWDA
NATIONAL WOOD WINDOW AND DOOR ASSOCIATION

National Fenestration Rating Council

Accredited Certification Program

ANDERSEN CORPORATION

Manufacturer stipulates that these ratings were determined in accordance with NFRC 100-91.℠

U-value	A	24" x 48"	0.32	Perma-Shield Casement With 5/8" HP 5-Argon Filled Low-E Glazing
U-value	B	30" x 60"	0.31	

NFRC ratings are determined for a fixed set of environmental conditions and may not be appropriate for determining seasonal energy performance. For additional information contact: NWWDA 1400 East Touhy Avenue, Suite G-54 Des Plaines, Illinois 60018; Phone (708) 299-5200, Fax: (708) 299-1286

> Window purchasers should inform suppliers that an NFRC sticker is needed.

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DESIGN TIPS

A good window design balances the need to collect heat and keep heat in the house during cold weather, and keep excess heat out during warm weather. The right windows, the number of windows, and the direction they face all contribute to a successful window strategy. Super Good Cents offers builders guidelines and design assistance for choosing and placing windows where they will contribute to comfort and efficiency, while fulfilling the owners' intentions for their new homes.

Take Advantage of the Sun!

Super Good Cents encourages builders to design houses that take advantage of solar gain during the heating season. Low-e coatings slightly decrease the amount of solar heat allowed to enter the window, compared to uncoated glass. The trade off is worthwhile in cold climates because the sun shines an average of only 11 hours a day during the heating season, but the windows lose heat at a much faster rate than the surrounding walls during the hours when the sun isn't shining. The heat-saving benefits of low-e glass over the 24 hour period outweigh the slight reduction in available solar gain.

Over-Heating

When overheating from too much summer sun is a problem, roof overhangs and trees can shade windows, or consumers can choose window coatings that permit varying amounts of light to enter while slowing heat gain. Tinted windows reduce both light and heat, while specialized coatings can slow heat gain without significantly reducing the amount of light entering the window. Coatings that stop heat from entering during hot weather also can slow heat leaving during the heating season. An increasing number of window suppliers offer builders specialized packages that include some windows designed to collect heat and others designed to block heat gain, to meet specific conditions in different areas of a house.

Shading Coefficient

Shading coefficient (SC) is a number that expresses the amount of solar heat a window allows to pass through compared to a clear pane of glass. The SC for 1/8 inch clear glass is 1.0. The lower the SC the less solar heat passes through.

How Many Windows?

Super Good Cents guidelines use a "window to floor area" ratio to determine how many windows a house can have. The total square feet of window area is compared to the square feet of living space and shown as a percentage. SGC limits glazing in most cases to 15 percent of the floor area. Larger amounts of glazing are allowed if the house or windows are very energy efficient. In most cases houses with more than 20 percent glazing will not qualify, unless the builder uses windows with very low U-values. The average house built in Montana in the last ten years has less than 13 percent glazing. Utility representatives should be asked to evaluate proposed window schedules.

Installation is Important Too!

The best windows are only as good as their installation. It is customary to stuff fiberglass into the space between the window and wall, but fiberglass does not stop air movement. Builders should use low-expansion foam over the fiberglass to seal the gap.

Skylights and Roof Windows

Skylights and roof windows can create atmosphere in a room and help turn attics and lofts into living space. Roof windows that open can provide passive cooling during warm weather.

They also are a hole in what is usually the most densely insulated part of the house - the roof. Warm air rises, and since skylights are often the highest point in a room, the warm air collects at their cool surface. Condensation often occurs on skylights, especially when they are located in bathrooms and kitchens.

Skylights also can contribute to overheating during the summer. Low-e coatings reduce heat gain to a degree, and most skylight and roof window manufacturers offer tints and coatings designed to reduce heat gain, some without visibly reducing the amount of light that enters.

Super Good Cents does not require NFRC ratings for skylights, though some manufacturers have submitted their skylights for certification.

* * *

Skylight Recommendations

Limit the number and size of skylights to minimize heat loss.

Choose locations that need extra light, but will not overheat excessively.

Remember that kitchens and baths produce moisture that will condense on skylights during cold weather.

Look for skylights with low U-values, using low-e coatings and gas-filled spaces.

WINDOW COMPONENTS

Windows are made up of parts that work together as a system. Manufacturers combine frames, glass, coatings, spacers, and gap fill to create products that fill various window needs. Each part serves a different function. The components are explained below.

Frames - Window frames generally fall into three categories: aluminum, vinyl, or wood. Wood frames are often clad with aluminum or vinyl. Aluminum frames conduct heat more freely than other frame types, and very few qualify for Super Good Cents (SGC). Wood and vinyl frames are better insulators, and most of the windows available in Montana that meet SGC requirements have wood or vinyl frames.

Glazings - Glass transfers heat rather quickly, but multiple glazings create insulating air spaces. Double and triple glazed windows are common, and some manufacturers use a polyester film suspended between panes of glass to create additional air spaces. The film is considered a glazing, so a triple glazed window could have two panes of glass with a film in the center rather than three panes of glass.

Low-e Coatings - Low-emissivity (e) coatings are reflective material bonded to either glass or plastic film that reflect long wave radiation. Low-e coatings can be applied to different glazing surfaces to keep heat in the house in cold climates, or keep it out of the house in hot climates. Most glazing films have a low-e coating.

There are several different types of low-e coatings, and some are more efficient than others. Hard (pyrolytic) coats are baked onto the glass and are very durable, but slightly less efficient than soft coats. Soft coats, also called "sputter" coats, are applied to cool glass. They have a bumpier surface that is more easily scratched until it is sealed inside a window unit, but soft coats usually are better at reflecting heat than hard coats.

Each low-e coating has an emissivity rating. The lower the number the less heat passes through. Hard coats emissivity ratings range from .180 to .500 and soft coats range from .040 to .150. Technology constantly improves, and new hard coats now approach soft coat performance.

Spacers - The spacer separates glazings, and is usually made of aluminum, which conducts heat very fast. Since the panes of glass make direct contact with the spacer, it forms a "thermal bridge" to conduct heat out. The cooler edge is where condensation first occurs in cold weather.

"Warm edge" spacer technology is one of the fastest-changing areas of window design. Manufacturers are using less conductive materials to slow heat loss through the spacer, resulting in a "warmer" edge. The warmer surface also means less condensation at the edge. Warm edge spacer technology can increase interior window surface temperatures by 5-6 degrees.

Gap - The distance between glazings and the material that fills the space can determine whether a window meets Super Good Cents requirements. A quarter inch air space in a double glazed window probably won't insulate enough for the window to meet Super Good Cents requirements. On the other hand, convective currents can form in large gaps (over three quarters of an inch,) which also reduces the insulating value of the window. Look for gaps in double glazed windows between a half and three

Window Components

- Frames
- Glazings
- Low-e Coatings
- Spacers
- Gap
- Gas Fills
- Operators

quarters of an inch. Triple and quad glazed windows usually have smaller gaps, but there are more of them, adding to the insulating value.

Gas Fills - Most manufacturers now offer windows filled with gas instead of air in their standard product lines. These gas fills slow conductive heat flow through the air space. The most common gas used is argon, an inert, non-corrosive, non-toxic gas that insulates better than air. Argon naturally makes up about 1 percent of the atmosphere. Commercial grade argon is very pure and fairly inexpensive. Many companies offer argon-filled windows at a cost the same as air-filled windows. Some manufacturers use krypton gas, which is more expensive but insulates better than argon, or a combination of gases.

Gases used in windows are stable and usually only leak out if the seal fails. Seal failures are noticed when moisture accumulates between the panes. Look for a reputable window company that offers a long warranty against premature seal failure.

Operators - Windows that open, such as casements, awnings and sliding windows, are called "operators". Operable windows by design allow more air leakage in and out of the home than fixed windows, though manufacturers constantly improve weatherstripping and closure mechanisms. NFRC does not currently include infiltration in window ratings, though they plan to add it to the rating formula in the future.

Sources

National Fenestration Rating Council Certified Products Directory January 1995

NFRC
1300 Spring Street, Suite 120
Silver Spring, Maryland 20910

1994 Long Term Super Good Cents Technical Specifications Exhibit X of RCA, Reference 3

Bonneville Power Administration
PO Box 3621
Portland, OR 97208-3621

Manufacturer's literature lists infiltration rates for windows by cubic feet per minute (CFM) per lineal foot of opening. You can use that number to compare the tightness of different types of windows and weatherstripping. For instance, one manufacturer lists infiltration rates for its product lines as follows:

Casement & Awning Windows	.02 CFM/Ft
Double Hung & Sliding Windows	.09 CFM/Ft
Sliding Patio Doors	.10 CFM/Ft
Swinging Patio Doors	.03 CFM/Ft

U-Value vs. R-Value

R-values **describe the ability of a material to resist the flow of heat. The higher the R-value the better a material insulates.**

U-values **are the opposite; they are a measure of how much heat passes through. The lower the U-value, the less heat passes through.**

When windows are rated by the NFRC they are assigned a U-value that reflects how the entire unit transfers heat. ***(The NFRC is discussed on page 3.)***

Final Thoughts. . .

Your local Super Good Cents utility representative is your best source of information on the program. Take your house plans in for recommendations on how to build energy saving features into your new or existing home.

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